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I. GENERAL INFORMATION

WARNING: This procedure contains limited warnings and cautions. Refer to the product Service Manual for a full listing of precautions.

NOTE: Verify that the System Master Switch is less than 60 months (five years) old. If 60 months (five years) or older, rebuild the switch assembly and note the date on the back of the switch.

WARNING: Datex-Ohmeda employees must follow the guidelines explained in HRFS451, Infection Control Procedures. Non Datex-Ohmeda users of this document must follow the applicable institution policy for infection control.

II. PRE-INSPECTION PROCEDURES**A. Gas Machine and Ventilator Mechanical and Visual Checks**

1. Check the condition and tightness of all cabinet/frame parts.
2. Check the casters for proper operation and mounting. **DO NOT LUBRICATE THE CASTERS.** Check the brake for proper operation.
3. Check the storage drawers for smooth operation. Verify the end stops function correctly.
4. Check the condition of the O₂ cartridge and sensor assembly, O₂ monitor battery and battery housing. Reinstall the O₂ sensor assembly into the absorber O₂ sensor port.
5. Replace all fan filters.
6. Check the condition and tightness of the display and monitor pod housings.
7. Check the condition of all front panels.
8. Check for proper mounting and smooth operation of all switches and rotary controls. Ensure all associated knobs are secure.
9. Verify that all labels are in place and are clearly legible.
10. Check all external tubing, including rubber goods, hoses and pipeline hoses, and ensure there is no deterioration and that they are securely attached.
11. Check that the bellows canister housing is not cracked, chipped or damaged. Also check the condition of the housing lettering.
12. Verify that the O&M Manual or Pre-operative checklist is present.
13. Check operation of tilt shelf.
14. Check all external electrical cabling. Be sure it is correctly connected and is not deteriorating.

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III. MACHINE AND ABSORBER LEAK TEST

A. Gas Machine High Pressure System/ High Pressure Leak Test

1. Ensure that the System Master Switch is in the OFF position. Remove all pipeline connections.
2. Open all cylinder valves. Verify that there is at least 1000 psi (745 psi for N₂O) or higher on the cylinder pressure gauges.
3. Close all cylinder valves. Verify that the pressure does not visibly drop in 1 minute.
4. Loosen the "T" handles and pull the cylinders back to verify that the pin index and strainer nipples are intact.

NOTE: It is normal to hear a momentary release of pressure.

5. For each double cylinder yoke:
 - a. Connect one cylinder to the double yoke.
 - b. Open the cylinder. Listen for a continuous leak at the unused yoke position. If you hear a leak, check the tightness of the check valve. Repair or replace as necessary.
 - c. Move the cylinder to the unused yoke position and repeat step b.
6. Tighten the "T" handle on each cylinder.

B. Common Gas Outlet Relief Valve.

1. Turn the System Master Switch to the Pneumatic ON position.
2. Open the oxygen cylinder.
3. Set oxygen flowmeter to 1 L/min.
4. Attach an approved pressure measuring device to the common gas outlet.
5. Ensure the common gas outlet relief valve relieves between 120 - 150 mmHg.
6. Remove the measuring device.
7. Close the oxygen cylinder.
8. Turn the System Master Switch to the OFF position.

C. Low Pressure Leak Test

Note: Annually, the Low Pressure Leak Test should be performed twice, once with all vaporizers removed and once with vaporizers installed. At the annual check, replace the vaporizer manifold and machining port O-rings.

1. Verify the integrity of low pressure leak test device.
2. Attach low pressure leak test device to the common gas outlet.
3. Check that each vaporizer is securely locked to the manifold and is in alignment with other vaporizers.
4. Open all flow control valves two full turns.
5. Ensure all vaporizers are OFF.
6. Repeatedly squeeze and release the hand bulb of the device until it remains collapsed.
7. If the hand bulb inflates in less than 30 seconds, locate and correct the leak.
8. Turn a vaporizer ON to its maximum setting, checking the concentration dial for smooth operation. Set the vaporizer to 1%. Repeat Steps 7 and 8 with the vaporizer ON.

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9. Check the interlock system to ensure that only one vaporizer at a time may be turned ON.
10. Turn the vaporizer OFF. Repeat steps 9 - 11 for each mounted vaporizer.
11. Fully close all flow control valves to their minimum settings.
12. Remove the test device from the common gas outlet and reattach the common gas outlet hose.
13. If a Blood Pressure Manometer is equipped, Check the calibration as follows:
 - a. Attach an approved test fixture to the fitting on the blood pressure inlet port.
 - b. Apply pressure until 200 mmHg \pm 4 is displayed on the test device and verify that 200 mmHg \pm 4 is indicated and maintained on the BP manometer.
 - c. Apply pressure until 100 mmHg \pm 4 is displayed on the test device and verify that 100 mmHg \pm 4 is indicated and maintained on the BP manometer.
 - d. Relieve the pressure and verify that 0 mmHg is indicated.

D. Pressure Sensor/Low O₂ Alarm

WARNING: Follow the appropriate agent evacuation/collection safety measures. Use the hospital evacuation system with the service gas-evacuator tee. If hospital evacuation system is not available, perform service in a well-ventilated area.

1. Connect all pipeline supplies and cylinder-only gas supplies (for example, Heliox).
 - a. Open all cylinder valves to ensure that the pneumatic circuits are pressurized.
 - b. Close cylinder valves for gases which also have pipeline supplies.
2. Turn the system master switch to the pneumatic ON position.
3. Set all flowmeters for 3 L/min.
4. Verify that the cylinder gauges for pipeline supplied gasses have not dropped to 0 psi. Such a drop would indicate that the flowmeters are being supplied by the cylinders.
5. Remove oxygen supply.
6. Ensure that the following events occur in the following sequence:
 - a. Audio alarm activates for at least 7 seconds and Pneumatic LED is off .
 - b. Flowmeter floats for all gases except O₂ fall to zero.
 - c. O₂ flowmeter float falls to zero.
7. Turn the Ventilator ON. Ensure that the Low O₂ Supply Pressure LED is ON and the audio alarm sounds.
8. Turn the Ventilator OFF.
9. Turn all flowmeters to their minimum settings.
10. Re-establish O₂ supply.
11. Verify that the audio alarm silences and the Pneumatic LED is ON.

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E. Scavenging System Checks

NOTE: The old style relief valve may allow a negative pressure indication up to -2 cmH₂O. If you find an old style relief valve, replace it with the new style valve assembly.

1. Check and/or replace as necessary:
 - a. 1/4 inch vacuum hose.
 - b. All unused evacuation ports must be capped.
 - c. Evacuation hoses.
 - d. Three (3) liter evacuation bag.
 - e. 19 mm scavenger tee for gas monitors.
 - f. Ensure that the double 19 mm connector, if fitted, is located beneath the scavenger valve.
2. Inspect and Clean
 - a. Remove positive and negative relief valve components.
 - b. Clean inside of manifold and beneath negative pressure button.
 - c. Clean needle valve and seat assembly. Lubricate the needle valve threads w/ Krytox, as necessary.
 - d. Replace positive and negative pressure gaskets as needed.
 - e. Reassemble the valve.

F. GMS Inspection

NOTE: For units manufactured prior to 1986, verify that the Inhalation Port pressure sensing nipple, a raised head gasket, a drain valve for adjustable height bag arms, and check valve disk retainers with stand offs are installed.

1. (EVERY 24 MONTHS) Manifold Inspection
 - a. Remove the access screen. Replace the cup seals every 24 months. Looking through the access screen opening, inspect the GMS manifold for contamination. If contamination is present, remove the manifold and clean or replace components as necessary.
2. Periodic Inspection
 - a. Gauge
 - 1) Remove the gauge assembly and inspect the O-ring; replace as necessary. Insert the gauge assembly into an approved test device (see tools appendix).
 - 2) Verify the accuracy of the gauge at:
 - 0 ± 1 cmH₂O (0 ± 0.7 mmHg)
 - 40 ± 1 cmH₂O (29.4 ± 0.7 mmHg)
 - 5 ± 3 cmH₂O (-3.7 ± 2.2 mmHg)
 - 3) If 5500 equipped, ensure that the patient pressure sensing line is attached to the test device. Verify that the 5500's sub-atmospheric pressure alarm activates at -10 ± 5 cmH₂O (-7.4 ± 3.7 mmHg).

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- 4) Return the gauge assembly to the absorber.
- 5) Ensure that the pressure sensing line is attached to the absorber.
- b. Check the integrity of the sensor port cap and O-ring. Replace as necessary.
- c. Check the condition of the Inhalation and Exhalation domes, O-rings, check valves and check disc retainers. Replace as necessary.
- d. Looking through the inhalation check valve seat and O₂ sensor port, inspect the GMS manifold for contamination. If contamination is detected, remove the GMS manifold and clean.
- e. Check the condition of the corrugated return hose. Replace as necessary.
- f. Check the condition of the canister gaskets, seals and upper gaskets. Replace as necessary.
- g. Inspect the canister dish; clean as necessary.
- h. For elevating arms, check the Bag Arm Tube Drain for cleanliness.
- i. Check for correct firm operation of the Locking Lever.
- j. Lubricate the GMS Mounting Pin, as necessary. Install a mounting pin gasket if one is not present.

G. Inhalation Check Valve

1. Remove the bag and the patient circuit, if installed.
2. Disconnect the gas supply hose from the common gas outlet.
3. Detach the bellows assembly from the GMS or, if remotely mounted, the hose assembly.
4. Connect the corrugated hose from the common gas outlet to the inhalation valve.
5. Set the O₂ flow to 200 ml/min.
6. Verify that the GMS gauge increases from 0 to at least 5 cmH₂O in 30 seconds.
7. Remove the corrugated hose from the common gas outlet.

H. GMS Selector Valve and Ventilator Port

1. Re-connect the gas supply hose to the common gas outlet.
2. Attach the free end of the corrugated hose to the 22 mm ventilator port on the back of the absorber.
3. Check for correct switching action of the selector valve by slowly switching it three times between Ventilator and BAG/APL. A single click indicates correct switching action. If other than a single click, replace the selector valve.
4. Set the BAG/VENT switch to VENT.
5. Flow O₂ until 40 cmH₂O is observed on the GMS gauge. Reduce the O₂ flow to 200 ml/min.
6. Verify that the GMS gauge reading does not drop in 10 seconds.
7. Open the drain plug and verify that the pressure on the GMS gauge depletes to zero.
8. Close the drain valve.

I. Exhalation Valve Assembly/APL Assembly

1. Bi-Annual APL Assembly Inspection (every 24 months only)
 - a. Remove the APL knob.
 - b. Remove the calibration screw, the spring and the APL needle.
 - c. Inspect the interior of the APL chamber for contamination.
 - d. Inspect the APL needle for nicks, wear or contamination.
 - e. Check the integrity of the calibration screw O-rings; replace as necessary.
 - f. Reinstall the APL needle, spring and calibration screw.
 - g. Remove the corrugated hose from the ventilator port and attach it to the bag arm.

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- h. Set the BAG/VENT switch to the bag position and turn the APL valve fully clockwise.
- i. increase flows to 3 L/min.
- j. Adjust the calibration screw for a maximum pressure of between 66 - 78 cmH₂O.
- k. Turn the APL valve fully counter clockwise.
- l. Verify that the gauge indicate 1 - 5 cmH₂O.
- m. Reinstall the APL knob.
- n. Proceed to step 3 of the Exhalation Valve/APL Assembly.
2. Remove the corrugated tubing from the ventilator port and attach it to the bag arm. Set the BAG/VENT switch to BAG and close the APL valve fully clockwise.
3. If 5500 equipped, set the 5500 high pressure alarm to 50 cmH₂O and sustained pressure alarm to 30 cmH₂O.
4. Flow O₂ until 40 cmH₂O is observed on the GMS Gauge.
5. Reduce O₂ flow to 200 ml/min.
6. Verify that the GMS gauge does not drop in 10 seconds.
7. If 5500 equipped:
 - a. maintain pressure and verify that the sustained pressure audio and visual alarms occur within 15 seconds.
 - b. silence the sustained pressure alarm.
 - c. slowly increase the O₂ flow to 50 cmH₂O.
 - d. verify that the high pressure alarm activates at 50 ± 5 cmH₂O. Verify that the bar graph matches the applied pressure.
8. If the bi-annual (24 month) GMS APL assembly inspection was performed at this visit, skip this test. Increase the O₂ flow to 3 L/min. Verify that the pressure relieves at between 65 and 76 cmH₂O.
9. Slowly turn the APL knob counter-clockwise in 1/4 turn increments.
10. Verify the smooth operation of the GMS gauge as the pressure drops with each turn of the APL valve.
11. Verify that the tactile indication ceases at approximately 30 cmH₂O and that the Sustained Pressure alarm resets.
12. Continue turning the APL knob until it is fully counter-clockwise.
13. If the bi-annual (24 month) GMS APL assembly inspection was performed at this visit, skip this test. Verify that the gauge indicates 1-5 cmH₂O.
14. Reconnect the bellows assembly to the absorber.

J. Waste Gas Interface Valve

1. Functional Check
 - a. Note the position of the interface needle valve.
 - b. Close the interface needle valve.
 - c. Adjust the O₂ flow to 6 L/min.

NOTE: For passive systems, cap the evacuation output port then proceed.

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- d. Observe for the following:
 - 1) In less than 1 minute, the evacuation bag should fill and the positive pressure valve should relieve.
 - 2) The absorber gauge should not indicate a pressure rise of more than 4 cmH₂O.
- e. Reduce O₂ to minimum.

NOTE: For a passive system, reattach evacuation output tubing. Step f need not be performed.

- f. Open the needle valve one full turn.
 - 1) Occlude the **absorber exhalation port** using the test plug.
 - 2) Negative pressures should not show on the absorber gauge.
 - 3) Verify that the evacuation bag is completely collapsed, the negative relief valve has relieved, and the absorber gauge is at 0.
- g. Return the needle valve to the position noted in step a.

K. PEEP Valve - New style - if so equipped

New style PEEP valves started with serial number AAXS01000. If you find an old style valve, call the Anesthesia Complaint Coordinator in Madison, at 1-800-521-0086, for disposition.

- 1. Pre-Operative Checkout
 - a. Check that the scale and knob labels are legible. If not, replace PEEP valve assembly.
 - b. Check that the instruction label is legible.
- 2. Inspection
 - a. Remove the PEEP Valve from the absorber.
 - b. Disassemble the lower section of the PEEP Valve and remove the blue check disk.
 - c. Verify that the pin moves side to side and freely in and out. Any restriction of movement indicates that cleaning is required.
 - d. Reassemble the valve and reinstall it on the absorber.
- 3. Testing

With the patient circuit attached, the ventilator turned "OFF", and the absorber switched to the ventilator mode, perform the following:

 - a. Remove the gas supply hose from the common gas outlet of the machine.
 - b. Attach one end of a 22 mm corrugated hose to the common gas outlet, attach the other end to the patient outlet of the "Y" connector in the patient circuit.
 - c. Turn the PEEP Valve fully clockwise to the maximum PEEP setting.
 - d. Press the flush button while observing the absorber pressure gauge. Typically, the indicated pressure will be approximately 40 cmH₂O. If the pressure exceeds 60 cmH₂O, the valve must be serviced or replaced.
 - e. Perform the following test:
 - 1) Flow 3 L/min of oxygen with the PEEP Valve knob turned fully clockwise.

NOTE: If the pressure reading is not in the recommended range, the spring may need replacing.

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- 2) Observe the pressure on the absorber pressure gauge. It should be between 16 and 27 cmH₂O.
- 3) Return the PEEP Valve to the "OFF" (fully counterclockwise) position and reduce the O₂ flow to minimum.
- 4) Remove the 22 mm corrugated hose from the common gas outlet and the "Y" connector. Reconnect the gas supply hose and any circuit connections previously removed.

IV. 7000 VENTILATOR TESTS

A. Pop Off Valve/ Bellows Retention Test

1. Connect the corrugated hose between the absorber inhalation and exhalation ports.
2. Set the BAG/VENT switch to VENT (GMS and 21 Absorber with selector switch).
3. Fill the bellows using oxygen flush.
4. Increase the O₂ flow from 200 ml/min to 10 L/min and ensure that the circuit pressure remains between 1 cmH₂O and 5 cmH₂O.
5. Increase the O₂ flow to the maximum and verify maximum stop.
6. Decrease O₂ flow to minimum.
7. Remove and occlude the bellows exhaust outlet tubing at the waste gas scavenging interface valve connection.
8. Use the O₂ flow control to obtain a steady pressure of 15 cmH₂O on the absorber pressure gauge.
9. Check the bellows for proper retention on the bellows base. Replace the bellows as necessary or if 15 cmH₂O cannot be obtained.
10. Remove the occlusion from the exhaust outlet and reconnect the hose.

B. Bellows Drop Test

1. Ensure the bellows is still at the top of the housing.
2. Set the BAG/VENT switch to the BAG position (For absorbers without a selector switch, turn the O₂ flow off).
3. The bellows must not drop more than 100 ml in one minute. For ABA Bellows, 100 ml is the top of the tapered white arrow printed on the bellows housing.

C. Breathing System Pressure Leak Test (Absorber, bellows assembly, manifold, and drive gas hose)

NOTE: Before performing this test, the bellows must be at the bottom of the housing.

1. Set the BAG/VENT switch to VENTILATOR position (GMS and 21 Absorber with selector switch).
2. Disconnect the 17 mm Drive Gas hose at the back of the ventilator and occlude the hose with a test plug.
3. Observe the pressure gauge while slowly increasing the O₂ flow until the pressure reaches 30 cmH₂O. Quickly reduce the flow until the pressure stabilizes.
4. The O₂ flowmeter reading is the total system leak rate. Verify that the leak rate is not greater than 225 ml/min.

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NOTE: If this test is performed with a patient circuit with an occluded 'Y' piece, the allowable leak rate is 300 ml/min.

- Remove the corrugated hose, the test plug from the drive gas hose, and occlusions on any gas sampling connections. Reconnect the drive gas hose.

V. ADDITIONAL SYSTEM CHECKS

A. 2120 Leak Test (If the system has a 2110, see appendix D for this procedure)

NOTE: This test begins now and is concluded later in the procedure.

- Connect a 12 ft double lumen hose to the SENSE and INFLATE fittings of the Modulus II Patient Interface Panel. Inspect all cuff and hose connections prior to performing this test. Repair or replace any worn parts.
- Attach an NIBP cuff and wrap the cuff around a solid cylinder.
- Depress the hold button while turning the monitor ON. Release the hold button after all 0's appear.
- Verify the monitor beeps during the test.

B. O₂ Calibration

- Calibration/Alarms Testing
 - Note the high and low O₂ alarm settings.
 - Connect the O₂ sensor assembly and test device to the Common Gas Outlet.
 - Verify that all O₂ display segments are working. Verify that the backlighting is ON (5120 only).
 - Set the high O₂ Alarm to 95%.
 - Introduce the O₂ sensor assembly to 100% concentration of oxygen and allow the display to stabilize.
 - Calibrate to 100% O₂ and verify that the High O₂ alarm activates (audio and visual).
 - Remove the O₂ sensor assembly from 100% Oxygen and expose it room air. Verify that the High O₂ alarm cancels.
 - Set the Low O₂ alarm to 25%. Verify that the Low O₂ alarm activates, and verify that the monitor stabilizes at 21% \pm 3% within 3 minutes.
 - Press alarm silence and verify that the audible alarm is silenced.
 - Set the Low and High O₂ alarm to their original setting.

C. Proportioning System

WARNING: Use the hospital evacuation system with the service gas-evacuator tee. If hospital evacuation system is not available, perform service in a well-ventilated area.

- Every 12 months, perform flowmeter verification on O₂ only at the following flows: 500 ml/min, 1L/min, and 5 L/min.

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- Use the N₂O Flow Control Valve and perform the tests in Table A progressively from low to high flows. Do not overshoot any setting. Allow the System O₂ monitor to stabilize between readings.

TABLE A			
Set the N ₂ O Flow to (L/min)	The Oxygen Flowmeter Must Read:		
	MIN (L/Min)	Max (L/min)	System O ₂ Monitor
0.9	0.24	0.36	20-30%
6.0	1.58	2.44	20-30%
12.0	3.16	4.89	20-30%

- Increase N₂O flow to maximum and verify maximum stop.
- Increase O₂ to 6 L/min.
- Use the O₂ Flow Control Valve and perform the tests in Table B progressively from high to low flows. Do not overshoot any setting.

TABLE B			
Set the O ₂ Flow Cont. Valve to (L/Min)	The N ₂ O flow must then read:		
	Min N ₂ O (L/Min)	Max N ₂ O (L/Min)	Oxygen Monitor
3.0	7.36	11.41	20-30%
1.0	2.46	3.80	20-30%
0.5	1.23	1.90	20-30%
0.3	0.74	1.14	20-30%

- Decrease N₂O to minimum, the O₂ float should not decrease at this time.
- For optional gas(es) use the appropriate table shown below.

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TABLE C		
Oxygen	He N ₂ CO ₂	Oxygen Monitor Range
4 L/min	2 L/min	61-71%
4 L/min	4 L/min	45-55%
4 L/min	8 L/min	28-38%

TABLE D		
Oxygen	Air	Oxygen Monitor Range
4 L/min	3 L/min	61-71%
3.5 L/min	6 L/min	45-55%
1.5 L/min	8 L/min	28-38%

TABLE E		
Oxygen	Heliox (25% Oxygen, 75% Helium)	Oxygen Monitor Range
4.0 L/min	3.0 L/min	63-73%
3.5 L/min	6.0 L/min	48-58%
1.5 L/min	8.0 L/min	32-42%

- Set all gas flows to minimum. Verify that the O₂ flowmeter indicates 200ml ± 25ml (50ml ± 10 ml for low flow systems).

D. Vaporizer Test

WARNING: Follow the appropriate agent evacuation/collection safety measures. Use the hospital evacuation system with the service gas-evacuator tee. Use the canister when appropriate vacuum systems are unavailable (Vapor Absorption Kit).

- Set the oxygen flow rate to 6 L/min.
- Turn on a vaporizer, slowly advance the vaporizer knob, through a percentage range of 0 to 1.0% while observing the oxygen flowmeter.

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3. The oxygen flow rate should not drop more than 1 L/min at any position.
4. Repeat Steps 2 through 3 for each of the vaporizer positions on the manifold.
5. Set the O₂ flow to minimum.

E. Completion of 2120 Leak Test, if equipped

1. Verify that the 2120 monitor passed at least five tests without failure.
 - a. Systolic = test counter (counts the total number of tests)
 - b. Diastolic = leak fail counter
 - c. Mean = beginning pressure
 - d. Rate = current pressure
 - e. Flashing Bar Graph = leak test indicator
 - f. Flashing Alarm LED = leak test indicator
 - g. Minutes = total valve failures.
2. To exit the leak test, turn the 2120 OFF.
3. Remove the cuff from the solid cylinder.

F. O₂ Flush Valve Test

1. Ensure that the flush valve button guard is secure.
2. Depress O₂ flush valve.
3. Ensure a high rate of flow is heard.
4. Ensure the low oxygen supply alarm does not activate.
5. Remove all test equipment.
6. Reattach the fresh gas hose to the common gas outlet.

VI. ADDITIONAL VENTILATOR TESTS

A. Bi-annual Ventilator Internal Component Check - Every 24 months only

1. Replace the battery. Write the replacement date on the battery.
2. Verify the integrity of the AC wiring.
3. Check the condition of the internal tubing and the Exhalation Valve; replace as necessary.
4. Verify that the correct fuse is installed. Units with a 3/4 amp label should have a 3/4 amp fast acting fuse. Units with no fuse label should have a 3/8 amp time delay fuse.

NOTE: The **3/8 Amp fast acting** should not be used for any future replacements.

NOTE: The replacement fuse for the 7000 Multi-Voltage Ventilator is a 1 Amp 250 Volt 5X20mm fast acting fuse.

B. Ventilator Flow Delivery Test

1. Disconnect the ventilator drive gas hose from the absorber. Connect a respirometer to the free end of the drive gas hose. (Use adapters as required)
2. Pressurize the patient pressure sensing line (distal sense) connected to the ventilator to 20 cmH₂O and maintain pressure. (This eliminates a low airway pressure alarm during the test).
3. Turn the ventilator power switch ON.
4. Set the ventilator controls per Table F. Allow three cycles to occur. Ensure that the volume is the same each cycle by re-zeroing respirometer between each cycle.
5. Compare the respirometer readings with the tidal volume limits in table F.

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Table F

CONTROL SET			RESPIROMETER VOLUME READINGS		
MV	R	I:E	MIN	NOMINAL	MAX
5	10	1:2	360 ml	500 ml	690 ml
10	20	1:3	430 ml	540 ml	670 ml
30	30	1:1	940 ml	1090 ml	1280 ml
6	30	1:2	160 ml	200 ml	250 ml
15	10	1:2	1290 ml	1620 ml	2070 ml

NOTE: Respirometer readings have been adjusted to compensate for respirometer response curve.

C. Alarm Tests

1. Push the lamp test button. All the lamps must light and the audio alarm must sound.
2. Set the controls to: MV-15, R-15, I:E-1:2.5
Vary the MV control as indicated; verify the alarm condition(s).

<u>MV</u>	<u>Alarm Condition(s)</u>
15 L/Min	None
15-20 L/Min	Actual I:E Less Than Dial Setting
20-25 L/Min.	Actual I:E Less Than Dial Setting and Set Volume Not Delivered.
15 L/Min	None

3. Relieve pressure on the patient pressure sensing line.
4. The "Low AirwayPressure" alarm must sound within 3 breath cycles.

D. Ventilator Electronic High Pressure Relief System.

NOTE 1: The electronic high pressure relief system should be present in all 7000 ventilators. If it is not present, retrofit the ventilator using the high pressure relief kit.

NOTE 2: There are two parts to this procedure, the first is verifying that the alarm threshold is triggered at the correct pressure. The second test, which is done later in conjunction with other alarm tests, checks that the alarm is actually triggered at the patient.

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Alarm Threshold Test

1. Apply a pressure greater than 65 cmH₂O (approx. 48 mmHg) to the patient pressure (distal sense) inlet.
2. When the inlet pressure is 65-75 cmH₂O (48-55 mmHg), verify that the "Set Volume Not Delivered" alarm lights and an audio alarm sounds.
3. With over-pressure present during the inspiration phase, the driving O₂ is vented from the control unit base until the inspiratory phase is complete.
4. Maintain the over-pressure condition and ensure that after 2-3 breaths, the ventilator goes into the "Ventilator Failure" mode and will continue to vent drive gas out of the control unit base during the inspiratory phase.
5. Remove pressure from the inlet. Verify that the "Set Volume Not Delivered" alarm resets but that the "Ventilator Failure" alarm remains latched.
6. Turn the unit OFF and then ON to reset the unit.

E. Mechanical Relief Valve Test

1. Set the controls to MV-2, R-10, I:E-1:1
2. Apply 20 cmH₂O to the patient pressure sensing line.
3. Remove the respirometer and attach an approved pressure measuring device.
4. Verify that the pressure starts relieving between 45-65 cmH₂O (33 - 48 mmHg) during inspiration.
5. Remove the test device. Turn the ventilator OFF and reconnect the drive gas hose.

F. Manual Ventilation Test

1. Connect a complete patient circuit, with a test lung, to the absorber. Maintain at least 2 L/min fresh gas flow so that the bellows remains fully extended.
2. Reattach the patient pressure sensing line to the absorber.
3. Turn the ventilator ON. Push the manual cycle button during the expiratory cycle to verify that the ventilator cycles.

G. Sigh Test

1. Set the controls to: MV-15, R-40, I:E-1:2
2. Turn the sigh switch ON and start stop-watch. Count breaths beginning with the first inspiratory cycle after the sigh is switched ON. On the 64th breath, ± 2 breaths (approximately 96 seconds) a larger breath, (approximately 150% of set volume) must be delivered.
3. Reset the all controls to its their original positions.

VII. VOLUME MONITOR

A. Pre-Inspection

1. Remove the TVX cartridge and sensor clip and inspect for cracks and physical damage.
2. Inspect the battery and compartment for damage. Replace the battery as necessary, or every 24 months. Record the replacement date on the battery.
3. (5420 only) Turn the monitor ON. Verify all segments are lit and the backlighting is on.
4. (5420 only) Verify function of Adult/Ped switch. Switch to Ped. and verify that PED is displayed and the green LED is on. Switch to Adult and verify Adu is displayed and the green LED is off.

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B. Functional Check

1. High Minute Volume Alarm Test
 - a. Set Ventilator controls to MV 6, Rate 10, I:E 1:1.
 - b. Set High Minute Volume Alarm to 4.
 - c. Verify the High Minute Volume alarm activates.
 - d. Reset High Minute Volume alarm to its original position.
2. Low Minute Volume Alarm Test
 - a. Set the Low Minute Volume alarm to 7.
 - b. Verify the Low Minute Volume alarm activates.
 - c. Press alarm silence to silence the alarm.
 - d. Reset the Low Minute Volume alarm to its original position.
3. Apnea Alarm
 - a. Turn the Ventilator OFF.
 - b. Verify the following occurs:
 - 1) After 30 sec., APNEA message appears on the display, LED begins to flash, one low-high tone sounds.
 - 2) After 60 sec., two low-high tones sound.
 - 3) After 90 sec., three low-high tones sound.
 - 4) After 120 sec., continuous low-high tones sound.
 - c. Turn the monitor OFF.
4. Flow Test
 - a. Ensure that the monitor is in minute volume mode.
 - b. Connect the TVX cartridge and sensor clip to common gas outlet with the gas flow arrow pointing away from the machine.
 - c. Set the O₂ flow to 6 L/min.
 - d. Turn the monitor ON.
 - e. Verify that the volume displayed is 6 ± 2 L/min.
5. Reverse Flow Test
 - a. Ensure that the reverse flow is turned on.
 - b. Reverse the direction of the sensor clip on the TVX cartridge.
 - c. Verify that the reverse flow alarm activates.
 - d. Return the sensor clip to its original position on the common gas outlet.
 - e. Simulate 3 breaths by occluding the TVX cartridge.
 - f. Verify that the reverse flow alarm cancels.
 - g. Turn the monitor OFF and reinstall the TVX cartridge and sensor clip on the absorber.
 - h. Reduce the O₂ flow to minimum.
 - i. Remove the test lung.

VIII. 5210 CO₂ MONITOR, IF EQUIPPED

A. Annual Visual Inspection

1. Disconnect the power cord.
2. Remove the electronics module cover.
3. Inspect all tubing for discoloration or other deterioration. Replace as necessary.
4. For units with membrane filter and water collection bottle only, do the following:
 - a. Replace, as needed, the water separator luer and tubing.
 - b. Inspect the three ports for the membrane filter to ensure they are not plugged.
 - c. Inspect the six O-rings on the membrane filter ports; replace as required.

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- d. Inspect the two O-rings for the water collection bottle; replace as required.

NOTE: If the monitor has the old style rotary vane pump, it should be replaced with a pump upgrade kit. Refer to Appendix B for the stock number.

5. If the present pump has a silver colored motor housing, replace the sample pump after 12 months. If the present pump is labeled 3003-056-VFB, and has a larger, black anodized "escap" pump motor housing, replace as needed. For both pumps, replace only with the larger black anodized pump motor assembly.
6. Reinstall the electronics module cover and plug in the power cord.

B. Periodic Inspection.

1. Place the monitor in the service mode by holding down the Waveform button and turning the power ON.
2. If equipped, check sample inlet filter; replace as necessary.

C. Flow Verification

1. Connect a sample line to the Sample Inlet.
2. Connect a flowmeter 0-600 ml/min to the exhaust port of the monitor.
3. Occlude the sample line and verify the flow drops to less than 10 ml/min.
4. Select Low Flow and verify the flow is between 90 - 170 ml/min.
5. Select High Flow and verify the flow is between 200-400 ml/min.

D. Service Mode Testing

1. Press Waveform to advance to PRESSURE INPUT FROM BENCH:
 - a. Remove the sample tube from the Sample Inlet.
 - b. Record the displayed voltage.
 - c. Refer to Table G, the corresponding pressure should be within $\pm 10\%$ of the current barometric pressure at the monitor's location.

NOTE: Be sure the barometric pressure used for comparison is the local value and is not corrected to sea level.
2. Press Waveform to advance to PUMP Vacuum Check:
With no sample line connected, note the displayed voltage. Block the Sample Inlet and again note the displayed voltage. The difference should be at least -5.0 V.
3. Press Waveform to advance to REFERENCE VOLTAGE:
The displayed voltage should be 6.5 ± 0.2 V. If required, adjust potentiometer R33 on the Measurement board to 6.5 V.
4. Press Waveform to advance to MATRIX DISPLAY CHECK: As the vertical bar scrolls from left to right across the upper display, verify that there are no gaps in the bar.
5. Press Waveform to advance to NUMERIC DISPLAY CHECK:
As the lower display cycles through numerals 0 to 9 and the formed characters (including the decimal point), verify that each segment of the display lights properly.
6. Press Waveform to advance to next test.
PURGE VALVE TEST: Connect a flowmeter (0 to 600 ml/min) to the Sample Exhaust. Occlude sample tubing inlet. Press the Reset control to start a purge cycle (lasts for 10 seconds). Verify the following:
 - a. A high pitch tone sounds,

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- b. The front panel Alarm indicator lights,
 - c. The flowmeters indicates a flow of less than 20 ml/min.
7. Press waveform to advance to monitor mode and verify:
 - a. The red "Alarm" indicator and the yellow caution indicator should each light briefly accompanied by a beep tone.
 - b. After approximately five (5) seconds, the message SELF-TEST COMPLETED is momentarily displayed on the upper display, switching to SYSTEM START, - WAIT -.
 - c. After another 15 to 45 seconds, the CALIBRATE (RESET TO START) screen should appear on the upper display.
 - d. All digits on the lower display should be displayed as eights (8), along with the annunciators (%), kPa, mmHg, and % N₂O.

E. Calibration Procedure

NOTE: The monitor should be on 5 minutes prior to calibration. First "CO₂ balance N₂" is used to check CO₂ span. Then, CO₂ with N₂O is used to check N₂O span and CO₂ compensation. Verify that the cal gas has not expired.

1. Zero Calibration
 - a. Verify monitor is in Low Flow.
 - b. With the full length of sample tubing connected to the monitor allow room air to be drawn into the monitor (Ensure the room air is free of appreciable levels of nitrous oxide and carbon dioxide).
 - c. If required, adjust the N₂O Zero and the CO₂ Zero controls until the upper display indicates 0% (N₂O) and 0.0% (CO₂).
2. CO₂ Calibration Only
 - a. Connect the free end of the sample tube to the 5% CO₂ balance N₂ cal gas can. Do not block off the open end of the adapter tube. The opening is required to bleed off excess pressure in the line.
 - b. Press down continuously on the valve stem of the gas canister. When the readings are stable, adjust the front panel CO₂ Span control until the reading matches the value of the CO₂ calibration gas (5% ±0.1).

NOTE: To ensure the calibration can is providing a sufficient flow of calibration gas to the monitor, continue to press down on the valve stem for five additional seconds and verify the readings remain stable. If the readings steadily decrease, an insufficient volume of calibration gas is indicated (depleted canister). Using a new can of calibration gas, repeat the Calibration procedure.

3. CO₂ and N₂O Calibration
 - a. Connect the CO₂ / N₂O calibration gas (65% N₂O, 5% CO₂, 30% O₂) canister.
 - b. Press down continuously on the valve stem of the gas canister. When the readings are stable, adjust the N₂O Span control until the reading matches the value of the N₂O calibration gas (65 ± 1%). Note the reading of the CO₂ measurement. It should be 5 ± 0.1%. If not, adjustment of the CO₂ compensation is required.
 - c. Disconnect the gas canister from the sample tube and allow the readings to return to zero.
 - d. If either reading does not return to zero, repeat steps 1 - 3.

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F. Operational Tests

1. With a sample line connected to the monitor, power it up and place it in the Ready mode. Select % for the display.

CAUTION: Do not touch the sample line to your mouth or face. When breathing into the sample line, hold it two to three inches away.

2. Blow into the sample line and verify a CO₂ waveform is displayed. Also verify the End Tidal Digital Display reads between 3 - 6%.
3. Set the high End tidal and Low End Tidal alarm values to trip these alarms.
4. Verify the audio and visual alarm indicators are activated for each of these alarms.
5. Clear the alarms and set the Apnea Delay switch to 30 seconds.
6. Do not breath into the sample line. Verify the Apnea flashing "Alarm" indicator and audio tone are active after 30 seconds.
7. Breath into the sample line. Verify the Apnea alarm is cancelled.
8. Momentarily block the sample line. Verify the monitor goes into the purge mode.
9. Turn the monitor OFF and return the alarm settings to their original positions.

Table G

Table G shows the barometric pressures (mmHg), which correspond to the pressure transducer's output voltage (P OUT) as displayed in Service Mode (Test 7);

NOTE: Values continue on next page.

Table G							
P OUT Volts	mm Hg	P OUT Volts	mm Hg	P OUT Volts	mm Hg	P OUT Volts	mm Hg
3.97	619	5.23	657	6.50	695	7.77	733
4.00	620	5.27	658	6.53	696	7.80	734
4.03	621	5.30	659	6.57	697	7.83	735
4.07	622	5.33	660	6.60	698	7.87	736
4.10	623	5.37	661	6.63	699	7.90	737
4.13	624	5.40	662	6.67	700	7.93	738
4.17	625	5.43	663	6.70	701	7.97	739
4.20	626	5.47	664	6.73	702	8.00	740
4.23	627	5.50	665	6.77	703	8.03	741
4.27	628	5.53	666	6.80	704	8.07	742

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Table G							
P OUT Volts	mm Hg	P OUT Volts	mm Hg	P OUT Volts	mm Hg	P OUT Volts	mm Hg
4.30	629	5.57	667	6.83	705	8.10	743
4.33	630	5.60	668	6.87	706	8.13	744
4.37	631	5.63	669	6.90	707	8.17	745
4.40	632	5.67	670	6.93	708	8.20	746
4.43	633	5.70	671	6.97	709	8.23	747
4.47	634	5.73	672	7.00	710	8.27	748
4.50	635	5.77	673	7.03	711	8.30	749
4.53	636	5.80	674	7.07	712	8.33	750
4.57	637	5.83	675	7.10	713	8.37	751
4.60	638	5.87	676	7.13	714	8.40	752
4.63	639	5.90	677	7.17	715	8.43	753
4.67	640	5.93	678	7.20	716	8.47	754
4.70	641	5.97	679	7.23	717	8.50	755
4.73	642	6.00	680	7.27	718	8.53	756
4.77	643	6.03	681	7.30	719	8.57	757
4.80	644	6.07	682	7.33	720	8.60	758
4.83	645	6.10	683	7.37	721	8.63	759
4.87	646	6.13	684	7.40	722	8.67	760
4.90	647	6.17	685	7.43	723	8.70	761
4.93	648	6.20	686	7.47	724	8.73	762
4.97	649	6.23	687	7.50	725	8.77	763
5.00	650	6.27	688	7.53	726	8.80	764
5.03	651	6.30	689	7.57	727	8.83	765
5.07	652	6.33	690	7.60	728	8.87	766
5.10	653	6.37	691	7.63	729	8.90	767

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Table G							
P OUT Volts	mm Hg	P OUT Volts	mm Hg	P OUT Volts	mm Hg	P OUT Volts	mm Hg
5.13	654	6.40	692	7.67	730	8.93	768
5.17	655	6.43	693	7.70	731	8.97	769
5.20	656	6.47	694	7.73	732	9.00	770

IX. 3710 Pulse Oximeter, if equipped

A. VISUAL INSPECTION

1. Verify that the probe connection and input and output jacks are in good condition.
2. Replace the battery every 48 months. Record the replacement date on the battery.

NOTE: Later revisions of software refer to SpO₂ instead of S_aO₂. For testing purposes, they are the same.

B. DIAGNOSTIC/CAL TESTS - ANNUAL ONLY

1. Turn the Modulus II System Master Switch to the OFF position.
2. Set the oximeter to run on battery power.
3. Enter the service mode by holding down the Alarm Volume button and turning the power ON. Follow the instruction on the display to perform the diagnostic and calibration tests.

C. OPERATIONAL AND ALARM TESTS

1. Turn the oximeter ON.
 - a. Verify that the Graphics Display indicates "Ohmeda-Biox 3700/3710/3700e Revision: X" and the digital display shows all eights, and then goes blank.
 - b. Verify the unit beeps two to three times and alarm indicator flashes twice.
2. Place a probe on your finger or ear (if ear probe). After the system check, verify that there is a good waveform displayed and that the S_aO₂ and Pulse Rate numbers are displayed.
3. Hold the "Waveform" key down for approximately 3 seconds. Verify that the message "FAST RESPONSE SELECTED" is momentarily displayed and that an "F" appears on the waveform display. Hold the "Waveform" key down again for approximately 3 seconds and verify that the message "SLOW RESPONSE SELECTED" is displayed momentarily and that the letter "S" appears on the waveform display.

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4. Verify that a pulse beep sounds once with each plethysmographic (SpO₂) pulse displayed on the waveform display.

NOTE: Proceed with audio alarm testing only after the initial two minute alarm silence period is over (Rev P and Later Software). The Alarm Silence Period for Rev M software is 1 minute after power up.

5. Verify the Patient Alarms are functional.
 - a. Set the high and low S_aO₂ and Pulse Rate Alarm limits beyond the readings. Ensure that the alarm tone sounds and the violated alarm limit and reading flashes on the Digital Display.
 - b. Verify that the ALARM SILENCE control temporarily silences all audible alarms for 2 minutes (30 secs for Rev. M) and changes the flashing LED alarm light to a steady red light.
 - c. Turn the oximeter OFF.
6. Verify trend data.
 - a. Depress and hold TREND 20/60 while depressing POWER/STANDBY control. Verify the message "PREVIOUS TREND DATA AVAILABLE" is displayed momentarily and then the oximeter enters the normal operating mode.
 - b. Depress the TREND 20/60 control. Verify that the displays for 20 minutes and 60 minutes of trend data are available.
 - c. Turn the oximeter OFF.
7. Set the Modulus II System Master Switch to the Pneumatic ON position.

X. 2120 NIBP, IF EQUIPPED (FOR 2110 NIBP, SEE APPENDIX D)

A. Annual Monitor Calibration

1. Calibration/ Overpressure Check
 - a. Enter the calibration mode by holding down the Start button and turning the power ON. Press the Period up arrow button to enter the Calibration Mode 01. Verify a beep tone and that the display shows calibration set up.
 - b. With "Sense" input port open, adjust R56 on the main board for "6" ± 3 (DC offset) on the Systolic display.
 - c. Verify "80" ±6 (Adult AC offset) in the Diastolic display. Adjust R54 as necessary.
 - d. Verify "80" ±10 (Neonatal AC offset) in the Rate display. Adjust R53 as necessary.
 - e. Verify "80" ±10 (Pleth AC offset) in the Mean display.
 - f. Disconnect the double lumen hose from the "sense" and "inflate" fittings on the Patient Interface Panel. Connect an approved test device to the "sense" and "inflate" fittings on the Patient Interface Panel.
 - 1) Increase the pressure testing device to 50 mmHg. The Systolic display should indicate 56 (±3). If necessary, adjust the GAIN control, R55.
 - 2) Increase the pressure testing device to 100 mmHg. Verify 106 (±3) is shown on the display. Adjust R55 as necessary.
 - 3) Increase the pressure testing device to 200 mmHg. The Systolic display should indicate 206 (±4). Adjust R55 as necessary.
 - 4) Repeat steps 1 through 3 until no adjustments are necessary.

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NOTE: The overpressure switch will interrupt monitor power if excessive pressure is sensed in the system. Do not adjust the overpressure switch unless the trip point deviates more than -10 mmHg or +15 mmHg from the nominal specification (270 mmHg).

- 5) Continue to slowly pressurize the system and note at what pressure the monitor cycles off to release the pressure (and go into the HOLD mode). The overpressure trip point should be 260 mmHg or greater but not more than 285 mmHg. As the pressure reaches the expected trip point, do not increase the pressure by more than 2 mmHg per second.
2. Back-up Timer
 - a. The monitor should be in the calibrate mode and about 50 mmHg pressure applied to the inflate port.
 - b. Start a stop watch and depress the Alarm Silence button to start the Back-up Timer.
 - c. Verify the following:
 - 1) The Timer activates at 41 to 59 seconds.
 - 2) The valve opens and releases air pressure.
 - 3) The alarm sounds the display goes blank and the Alarm LED flashes.
 - d. Turn OFF the monitor and remove the pressure testing device. Reattach the double lumen hose to the "sense" and "inflate" fittings on the Patient Interface Panel.
 3. Battery (24 Months Only)
 - a. Record options 7, 8 and 9 setting.
 - b. Turn the monitor OFF.
 - c. Replace battery and record date on the battery.
 - d. Reset the clock and restore options 7, 8 and 9 to those recorded in step a.

B. Periodic Inspection

1. Patient Alarm Tests
 - a. Place a cuff on your arm and connect it to the monitor using the double lumen hose.
 - b. Complete a blood pressure measurement and record the Systolic, Diastolic and Mean pressure displays.
 - c. Set the High Mean Alarm limit to 10 mmHg less than obtained in Step b.
 - d. Complete another blood pressure measurement and verify the following:
 - 1) The Mean display is higher than the High Alarm limit.
 - 2) The Red Alarm LED is flashing.
 - 3) The Mean Display is flashing and the audio alarm sounded.
 - e. Return High Mean Alarm limit to original setting.
 - f. Set the Low Mean Alarm limit to 10 mmHg greater than obtained in Step b.
 - g. Complete another blood pressure measurement and verify the following:
 - 1) The Mean display is lower than the Low Alarm limit.
 - 2) The Red Alarm LED is flashing.
 - 3) The Mean Display is flashing and the audio alarm sounded.
 - h. Turn the NIBP OFF and back ON, verify that all alarms cancel.

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2. Stat Mode Test, (if an NIBP probe is available)
This test verifies that the isolated pleth circuitry is performing normally.
 - a. Attach a finger clip probe to the finger probe connector. The monitor should be in the "Adult" mode.
 - b. With a finger inserted in the probe (the 2120 should be in "Hold"), the lamp in the "Sys-Stat" button should flash and a heart rate should appear in the "Rate" display. Dashes may appear while the monitor locks onto the pulse signal.
 - c. Pressing the "Sys-Stat" button should initiate the Sys-Stat Mode (the pump will start and the "Sys-Stat" lamp will come on continuously).
 - d. Press "Hold" to stop the pump.
 - e. With the finger probe disconnected from the finger, pressing the "Sys-Stat" button will not light and the pump will start inflating the cuff. Press "Hold" to exit this mode.

XI. ELECTRICAL SYSTEM

A. System Master Switch Display Check/Monitor Battery Checks

1. Ensure power is off before replacing batteries.
2. Replace the 7.2 Vdc battery located on the sensor interface board every 24 months. Record the date on the battery.
3. If 5500 equipped, replace the battery every 24 months; record the replacement date on battery.
4. Check that the LEDs illuminate when the System Master Switch is set to the ELECTRICAL "ON" and PNEUMATIC "ON." (For the "PNEUMATIC ON LED" to function, there must be oxygen supply pressure).
5. Check that all electrical devices function when the System Master Switch is in both the ELECTRICAL "ON" and PNEUMATIC "ON" positions.
6. Disconnect power cord.
7. Turn ventilator and all battery backed monitors ON.
8. Verify that after 2 minutes
 - a. 7000 Ventilator - The audio alarm should remain fully audible for the complete 2 minute period.
 - b. Mod II - The electrical disconnect/failure lamp blinks and the two-tone alarm cycles (3 seconds ON, 13 seconds OFF)
 - c. 5400/5420, 5100/5120, 5500, 3710 are operational.
9. Turn the ventilator and all monitors OFF.
10. If equipped, verify that the 5400 is on external power.

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XII. ELECTRICAL SAFETY TESTS

A. Electrical Safety Tests

NOTE: Perform electrical Safety Tests every 6 months, or if the covers to a machine(s) is removed.

NOTE: If tests are conducted with power from an isolated electrical power system, conduct the tests as detailed below and record "ISOLATED POWER SYSTEM" on the MSR detail block. Do not use an electrical jumper plug to defeat the isolation of the power system.

1. Disconnect all pipeline hoses from the medical gas outlets.
2. Disconnect all electrical monitors and accessories from the unit under test.
3. Plug the unit under test into the safety analyzer. Plug the analyzer into a 110 volt electrical outlet.
4. Set the safety analyzer to measure line voltage. Verify normal polarity is displayed.
5. Connect the grounding clip assembly to the safety analyzer.
6. Ground Resistance Check
 - a. Perform a ground resistance check. Use the electrical safety analyzer to measure the resistance between the ground pin on the line cord plug and exposed metal of the common gas outlet(or enclosure for monitoring products) and frame. The ground resistance must be equal to or less than 0.10 ohms.
7. Chassis Leakage Current:
Measure the chassis leakage current for the following configurations:
 normal polarity - neutral closed - ground closed
 normal polarity - neutral closed - ground open
 reverse polarity - neutral closed - ground closed
 reverse polarity - neutral closed - ground open
 The chassis leakage current must be less than 100 microamps in all cases.
8. Repeat steps 3-7 for each Datex-Ohmeda monitor and accessory on contract removed in step 2.

XIII. FINAL MACHINE CHECKS

- A. Disconnect all test devices and reconnect pipeline hoses, monitors and accessories that were previously removed.

Ensure the following:

- B. All vaporizers are OFF.
- C. The fresh gas hose is connected.
- D. All flow control valves are at the minimum stop.
- E. The APL valve is Open (minimum setting).
- F. Verify correct operation of lightbar (if equipped).
- G. All panels and tray top are attached.
- H. The pipeline hoses are connected.
- I. All cylinder gauges are at zero.
- J. All units are plugged into an appropriate power source.

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**Appendix A
Required Tools**

Item #	Description	Part Number	Equipment
1	22mm "T" Manifold	0212-0763-100	Mod II, 5100/5120
2	Cello-Seal	0220-5160-300	GMS
3	Digital Multimeter	7000-0000-023	Mod II, 2120, 3710, 5210,
4	Disposable Gloves (MD/LG)	7000-0000-010	All
5	Disposable Gloves (SM)	7000-0000-009	All
6	Electrical Analyzer BET 300AD / Dale 600	0175-2305-000	All but Abs.
7	Electronic Leak Detector	7000-0000-004	Mod II
8	Flowmeter Verification Device	0309-1324-810	Mod II
9	Flowmeter Outlet Subassembly	0236-0268-701	Mod II
10	Evacuation Service Kit	0175-2278-000	Mod II
11	Low Pressure Leak Test Device	0309-1319-800	Mod II
12	Manifold Plug	0236-0220-500	Mod II
13	O-ring for Manifold Plug and item 9	0210-0565-300	Mod II
14	O ₂ Monitor	0304-2178-800	Mod II
15	Tamper Proof Screwdriver	0175-2299-000	Mod II
16	Meriam Smart Manometer 0 - 100 psi	Call Cal Lab/Purchase Locally	All
17	High Pressure Manometer Fitting Kit	See MP 1011	All
18	Meriam Smart Manometer 0-1000 mmHg	Call Cal Lab/Purchase Locally	All
19	Low Pressure Manometer Fitting Kit	See MP 1011	All
20	Valve Assembly Tool	0175-2368-000	Mod II
21	Valve Body Wrench	0175-2391-000	Mod II
22	Brush	1400-3007-000	GMS (PEEP)

Maintenance Procedures

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Item #	Description	Part Number	Equipment
23	Krytox	1001-3854-000	GMS
24	40 " Corrugated Tube, Rubber w/22mm bushings	0211-9005-800	GMS, 5100/ 5120
25	Sealant, Silicone Rubber	0220-5251-300	GMS
26	Ring Pliers	0175-2364-000	GMS
27	Test Plug	2900-0001-000	GMS, 7000
28	Torque Screwdriver	0175-2038-000	GMS
29	Torque Adapter - 5/32" hex bit	0175-2385-000	GMS
30	Torque Adapter - 3/16" hex bit	7000-0000-056	GMS
31	Drive Gas Hose, 10"	0211-0118-300	7000
32	Respirometer	1603-3000-000	7000
33	Stop Watch	0175-1629-000	7000, 2120, 5500
34	Test Lung	0219-7210-300	7000
35	Calibration Gas, N ₂ O and CO ₂	0237-2120-300	5210
36	Calibration Gas, CO ₂ balance N ₂	0237-2134-300	5210
37	DB25 Male Pin Connector	0690-1561-421	5210, 3710
38	Dental Pik (for removing O-rings)	Local Purchase	5210
39	Extension Cable	0175-2394-000	5210
40	Flowmeter (0-600 ml/min)	6024-0000-006	5210
41	Patient Sample Line, 10 Pack	6026-0000-009	5210
42	O-ring Insertion Tool	7000-0000-075	5210
43	Oxiclip w/ cable	6051-0000-049	3710
44	Pins for DB25 Connector	0690-2600-368	3710
45	Digital Multimeter	7000-0000-023	7800

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**Appendix B
Required Parts**

<u>Model</u>	<u>Description</u>	<u>Part Number</u>	<u>Frequency</u>
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5210 CO2 Monitor
Revision B&C Models

1.	Inlet Tubing	6050-0005-701	As Required
2.	Measuring chamber	0237-2127-300	As Required
*3.	O-Rings for filter (6)	6027-0000-090	As Required
4.	O-Rings (2)water trap	6016-0000-032	As Required
5.	Outlet Tubing	6050-0005-702	As Required
6.	Pump Assembly	6050-0003-269	As Required
*7.	Separator Tubing	6026-0000-041	As Required
*8.	Separator luer	6050-0001-597	As Required
9.	Transducer Tubing	0995-6374-010	As Required
10.	Wash Inlet Tubing	6050-0000-390	As Required
11.	Wash Outlet Tubing	6026-0000-017	As Required
*12.	Water Separator Filter	6050-0004-289	As Required

*Revision "C" monitors only.

5210 CO2 Monitor
Revision A Model

1.	Inlet Tubing	6050-0005-701	As Required
2.	Measuring Chamber	0237-2127-300	As Required
3.	Outlet Tubing	6050-0005-702	As Required
4.	Pump	6050-0003-269	As Required
5.	Pump Upgrade Kit	6050-0001-401	As Required
	1 ea Instr Instl Pump 5210		
	1 ea Res MF 1/4W 1% 4.75K		
	.2500 ea Tube Silicone 1/16" I.D.		
	1 ea Assy Pump Upgrade 5210		
6.	Transducer Tubing	0995-6374-010	As Required
7.	Wash Inlet Tubing	6050-0000-390	As Required
8.	Wash Outlet Tubing	6026-0000-017	As Required

3710 Pulse Oximeter

1.	Battery	0279-0102-300	Every 48 Months
2.	Software Upgrade Kit (for disposable probes)	6050-0003-284	As Required

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<u>Model</u>	<u>Description</u>	<u>Part Number</u>	<u>Frequency</u>
2120 NIBP Monitor			
1.	Backlight	6002-0000-035	As Required
2.	Battery (4.5V)	0219-3581-300	Every 24 Months
3.	Resistor Upgrade Kit	6050-0001-883	As Required
	1 ea Instr Instl Main BD Upgrade		
	1 ea Res MF 1W 1% 200 OHM		
	1 ea RES MF 1/4W 1% 6.04K		
	.0420 ea TBG Teflon 18 Gauge		
	1 ea Addn, Svc, 2120 BD Mod		
4.	Software Upgrade Kit, Rev. 31	6050-0002-332	As Required
	1 ea Btry 4.5V 2110		
	1 ea Customer Letter 2120		
	1 ea Instr, Instl, Rev 31 Software		
	1 ea Prom Set (2120) #AM11		
	1 ea IC, Clk.Serial Time Keeper		
	1 ea Bag Anti-Static 3 X 5		
	1 ea Addn, OM, 2120 (RV.30)		
	1 ea Addn, Svc, 2120 (RV.30)		
	1 ea LBL 2120 Batt Instl Date		
	1 ea Foam Conductive 2"x2"x1/4		
5120 O2 Monitor			
1.	Outer O-ring	0210-0503-300	As Required
2.	Inner O-ring	0210-0499-300	As Required
	The batteries and cartridge are user replaceable and not covered by an MA contract.		
5400/5420 Volume Monitor			
1.	Battery	0690-1000-311	24 Months
5500 Pressure Monitor			
1.	Battery	6021-0000-005	24 Months
7000 Ventilator			
1.	Battery	1502-3016-000	24 months
2.	Bellows, Adult ABA	1500-3378-000	As Required
3.	Bellows, Pediatric Non ABA	0229-1018-700	As Required
4.	Diaphragm and Seat Assy, ABA	1500-3377-000	As Required
5.	Disk/ Ring /Bumper Assy, ABA	1500-3381-000	As Required
6.	O-ring, large, pop-off valve Non ABA	1500-3267-000	As Required
7.	O-ring, small, pop-off valve Non ABA	0210-0593-300	As Required
8.	O-ring, drive gas nipple	0210-0593-300	As Required
9.	Retaining ring, Ped Bellows Non ABA	0229-0036-300	As Required
10.	Seal, ABA	1500-3359-000	As Required
11.	Seat, Free Breathing Valve	0207-5590-100	As Required
12.	U Cup Seal Non ABA	0210-0784-300	As Required

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<u>Model</u>	<u>Description</u>	<u>Part Number</u>	<u>Frequency</u>
GMS Absorber			
1.	APL Valve Service Kit	0216-6785-870	As Required
	1 ea Instr Instal GMS Apl Repl Parts		
	1 ea Label Set ABS GMS		
	1 ea Shaft Needle		
	1 ea Seat Valve APL		
	2 ea O-Ring 1-1/16OD 15/16ID		
	1 ea Disk APL 1.03D BL Delrin GMS ABS		
	2 ea Washer .946ID 1.1960D .016T Brass		
	2 ea Ring Retainer 15/16Shaft Truarc #5103-93H ST ST		
	1 ea Grommet APL Valve		
	1 ea Ring Locking APL Valve		
	1 ea Spring, Com 12.70D 38.1L		
2.	Canister Gaskets	0210-1214-100	As Required
3.	Canister Seals	0210-1218-300	As Required
4.	Disk Valve - PEEP	0210-5297-100	As Required
5.	Disk Retainer - PEEP	0207-1642-542	As Required
6.	Dome - PEEP	0207-1638-100	As Required
7.	Instruction Tab - PEEP	1400-3006-000	As Required
8.	Manifold Gasket with Risers	0229-2077-100	As Required
9.	Washer Pin Gasket	0202-0094-300	As Required
10.	O-Ring - Bag Arm Drain	0210-0483-300	As Required
11.	O-Ring - Gauge	0210-0566-300	As Required
12.	O-Ring - Lower Dish Drain, New Style	0210-0594-300	As Required
13.	O-Ring - Lower Dish Drain, Old Style	0210-0481-300	As Required
14.	O-Ring	0210-0574-300	As Required
15.	Pivot Bracket	0229-2085-200	As Required
16.	Retaining Ring - PEEP	0203-5249-300	As Required
17.	Return Tube	1400-3009-000	As Required
18.	Screen	0214-7167-535	As Required
19.	In/Exhalation Check Valve Service Kit	1400-8011-000	As Required
	2 ea O-Ring 2-1/16OD 1-7/8ID		
	1 ea O-Ring 9/16OD 7/16ID		
	2 ea Disc Chk Vlv Rvsbl		
	2 ea Pad Die Cut 2-1/2 X 1-1/4		
	2 ea Dome Valve Check		
	2 ea Cup Seal		
	1 ea O-Ring .437ID .625OD		
20.	2 ea Cup Seal	0229-2007-100	24 Months
21.	Service Kit - Selector Valve GMS	0216-6782-800	As Required
	1 ea Bearing .130 DIA X. 250L		
	1 ea Bearing Nylon .250ID		
	1 ea Bushing Selector Valve		
	1 ea O-Ring .500 ID .625 OD .062W EPR 80 Duro		

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<u>Model</u>	<u>Description</u>	<u>Part Number</u>	<u>Frequency</u>
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GMS Absorber

	1 ea O-Ring 1/8X1/4X1/16 EPR		
	1 ea O-Ring .250ID .375OD .062W EPR 78 Duro		
	1 ea Roller		
	1 ea Sleeve Pivot Pin		
	1 ea Instr Instal Kit Selector Valve & Gauge Sensing		
	1 ea Spring Com		
	2 ea Ring Truarc .125 Shaft #5133-12H E-Ring		
	1 ea Adapter Barbed End 1/16ID Tube X 6-32 THD		
	1 ea Net, HT 6-32, Full MCH, SST		
	1 ea Pin Pivot		
	1 ea Retainer Cover		
	1 ea Shaft Retaining Ring		
	1 ea Bracket Support		
	1 ea Shaft Selector Valve		
	1 ea Bracket Pivot		
	2 ea Washer .438OD X .128ID X .065T Delrin		
	1 ea Tube Connector Patient Press 1/16ID Silicone Med		
	1 ea Washer No 6 Flat SST		
22.	Spring - PEEP	1400-3023-000	As Required
23.	Thrust Pin - PEEP	0207-1635-500	As Required
24.	Upper Gasket	0210-1057-100	As Required
25.	Washers - Switch Assy.	0402-1044-500	As Required

Modulus II

1.	Battery 7.2V	1502-3016-000	24 Months
2.	Fan Filter	0219-3849-300	Each Visit
3.	Gasket, Yoke Cylinder Valve	0210-5022-300	As Required
4.	Index Pin	0201-0503-500	As Required
5.	Inlet Strainer Nipple w/ Filter	0206-2806-725	As Required
6.	Kit Repair ON - OFF Switch	1010-8063-000	5 Years
7.	O - Ring Tec Port Manifold	0210-0736-300	12 Months
8.	Yoke Plug	0206-3040-542	As Required
9.	Yoke Check Valve Repair Kit	0236-5035-870	As Required

Waste Gas Interface Valve

1.	Waste Gas Scavenging Valve Assy	1001-8889-000	As Required
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Appendix C * Maintenance Procedure Revision Log

Description of Changes	Originator	Revision Date	New Revision Number
1) Revised Appendix A Required Tools	M. Rogers	07/2004	3.00
2) Revised the confidentiality statement			
3) Deleted 21 absorber and 2110 NIBP Monitor appendix			

*** Note:** This document has been under revision control, but a revision history has not been required to be included with this procedure. From this revision going forward, this log will be updated to inform the user of changes made to this document.